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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,311	09/26/2003	Adrianne K. Tipton	NOVLP075/NVLS-000820	4463

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EXAMINER	
COLEMAN, WILLIAM D	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 12/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/672,311	TIPTON ET AL.	
	Examiner	Art Unit	
	W. David Coleman	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 22 October 2004.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-37 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-36 is/are rejected.

7)☒ Claim(s) 37 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see remarks and Rejections under 35 U.S.C 102, filed October 22, 2004, with respect to the rejection(s)of claim(s) s 1-5, 8-11, 13-22, 24-30 and 32-36 under U.S. Patent 6,444,715 (Lukas) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Lukas et al., U.S. Patent Application Publication No.: US 2004/0096672 A1.

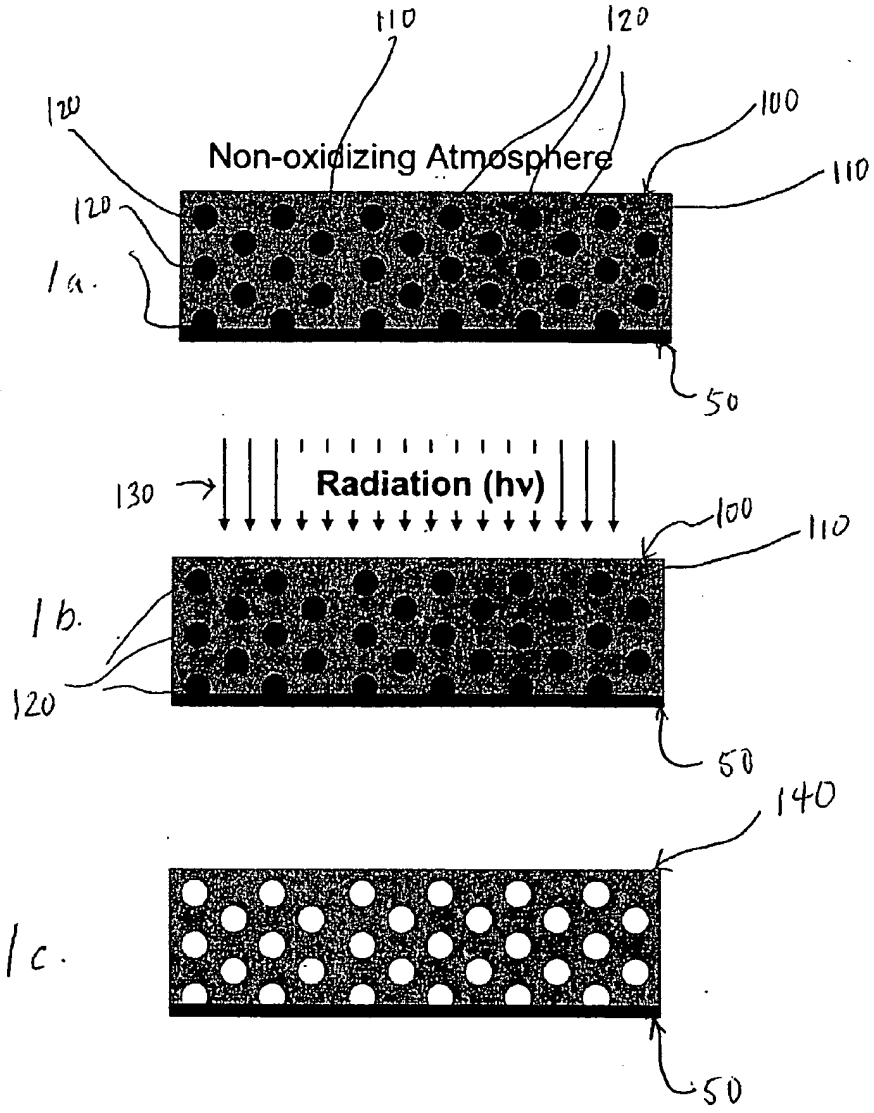
Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-37 are rejected under 35 U.S.C. 102(e) as being anticipated by Lukas et al., U.S. Patent Application Publication No: US 2004/0096672 A1.

4. Lukas discloses a semiconductor process as claimed. See **FIGS. 1a-1c**, where Lukas teaches the claimed process.


110
120
120
100
Non-oxidizing Atmosphere
110
120
1a.
50
130
Radiation (hv)
100
110
1b.
120
50
140
1c.
50

FIGs. 1a – 1c

5. Pertaining to claim 1, Lukas teaches a method of preparing a porous low-k dielectric material on a substrate, the method comprising:

forming a precursor film on the substrate, the precursor film comprising a porogen and a structure former; and

exposing the precursor film to ultraviolet radiation to facilitate removing the porogen from the precursor film and thereby create voids within the dielectric material to form the porous low-k dielectric material (see abstract).

6. Pertaining to claim 2, Lukas teaches the method of claim 1, wherein the precursor film comprises a porogen and a silicon-containing structure former[0025].

7. Pertaining to claim 3, Lukas teaches the method of claim 1, wherein the precursor film is formed by co-depositing the porogen with the structure former [0050].

8. Pertaining to claim 4, Lukas teaches the method of claim 1, wherein the structure former is produced from at least one of a silane, an alkylsilane, an alkoxysilane and a siloxane [0030].

9. Pertaining to claim 5, Lukas teaches the method of claim 4, wherein the structure former is produced from octamethylcyclotetrasiloxane (OMCTS), tetramethylcyclotetrasiloxane (TMCTS) or a combination thereof [0030].

10. Pertaining to claim 6, Lukas teaches the method of claim 1, wherein the porogen comprises a polyfunctional cyclic non-aromatic compound [0019].

11. Pertaining to claim 7, Lukas teaches the method of claim 6, wherein the polyfunctional cyclic non-aromatic compound is alpha-terpinene compound [0019].

12. Pertaining to claim 8, Lukas teaches the method of claim 1, wherein the porogen has ordered structure (see FIG. 1c).

13. Pertaining to claim 9, Lukas teaches the method of claim 8, wherein the porogen comprises a mesoporous structure formed from a block copolymer [0047].

14. Pertaining to claim 10, Lukas teaches the method of claim 1, wherein the porogen and structure former exist in one precursor molecule [0051].

15. Pertaining to claim 11, Lukas teaches the method of claim 10, wherein the compound is an organic silane [0030].

16. Pertaining to claim 12, Lukas teaches the method of claim 10 wherein the compound is di-tert-butyl-sliane silane [0030]

17. Pertaining to claim 13, Lukas teaches the method of claim 1, wherein the precursor film is formed by a chemical vapor deposition process [0044].

18. Pertaining to claim 14, Lukas teaches the method of claim 1, wherein the precursor film is formed by a spin-on technique [0032].

19. Pertaining to claim 15, Lukas teaches the method of claim 1, wherein exposing the precursor film to ultraviolet radiation takes place in an inert environment.

20. Pertaining to claim 16, Lukas teaches the method of claim 15, wherein the ultraviolet radiation comprises light with a wavelength at or near an absorption peak of the porogen.

21. Pertaining to claim 17, Lukas teaches the method of claim 15, wherein the inert environment comprises a gas selected from the group consisting of nitrogen, argon, helium and hydrogen.

22. Pertaining to claim 18, Lukas teaches the method of claim 15, wherein the inert environment comprises vacuum conditions.

23. Pertaining to claim 19, Lukas teaches the method of claim 1, wherein exposing the precursor film to ultraviolet radiation takes place in the presence of oxygen.

24. Pertaining to claim 20, Lukas teaches the method of claim 19, wherein the ultraviolet radiation comprises light having a wavelength that produces at least one of ozone and oxygen radicals.

25. Pertaining to claim 21, Lukas teaches the method of claim 1, wherein the substrate temperature during exposure to ultraviolet radiation ranges between about 25 and 450 degrees Celsius.

26. Pertaining to claim 22, Lukas teaches the method of claim 1, further comprising annealing the porous low-k dielectric material.

27. Pertaining to claim 23, Lukas teaches the method of claim 1, further comprising exposing the porous low-k dielectric material to a silanol capping agent (the Examiner takes the position that since Lukas teaches using the porous low-k dielectric as an interlayer dielectric, Lukas meets this limitation [0071].

28. Pertaining to claim 24, Lukas teaches the method of claim 23, wherein the silanol capping agent is selected from the group consisting of disilazanes, chlorosilanes, aldehydes, and combinations thereof (please note that the Examiner takes the position that Lukas discloses the use of hexamethydisilazane which has been miss-spelled hexanethydisilazane).

29. Pertaining to claim 25, Lukas teaches the method of claim 23, wherein the silanol capping agent is HMDS (please note that hexamethyldisilazane is abbreviated HMDS).

30. Pertaining to claim 26, Lukas teaches a method of preparing a porous low-k dielectric material on a partially fabricated integrated circuit, the method comprising:

providing the partially fabricated integrated circuit to a process chamber (because Lukas discloses interconnectivity in paragraph [0071], as partially fabricated integrated circuit is disclosed), wherein the partially fabricated integrated circuit comprises a precursor film having a porogen and a structure former;

exposing the partially fabricated integrated circuit to ultraviolet radiation in an inert environment such that the ultraviolet radiation interacts with the porogen to produce a volatile decomposition products; and removing the volatile decomposition products from the precursor film, leaving the porous low-k dielectric material on the partially fabricated integrated circuit (as applied to claim 1 above).

31. Pertaining to claim 27, Lukas teaches the method of claim 26, wherein the ultraviolet radiation comprises wavelengths ranging between about 156 and 500 nn (it is well known that ultraviolet wavelength fall within the claimed range).

32. Pertaining to claim 28, Lukas teaches the method of claim 26, wherein the inert environment comprises an inert gas [0062].

33. Pertaining to claim 29, Lukas teaches the method of claim 28, wherein inert gas is at least one of nitrogen, argon, helium or hydrogen gas [0062].

34. Pertaining to claim 30, Lukas teaches the method of claim 26;, wherein the inert environment comprises vacuum conditions.

35. Pertaining to claim 31, Lukas teaches the method of claim 26, further comprising: annealing the porous low-K dielectric material; and exposing the porous low-k dielectric material to a silanol capping agent [0044 & 0071]

36. Pertaining to claim 32, Lukas teaches a method of preparing a porous low-k dielectric material on a partially fabricated integrated circuit, the method comprising: providing the partially fabricated integrated circuit to a process chamber, wherein the partially fabricated integrated circuit comprises a precursor film having a porogen and a structure former; and exposing the partially fabricated integrated circuit to ultraviolet radiation in the presence of oxygen to produce oxidizing conditions in which the porogen is oxidized to produce porogen oxidation products, which are removed from the precursor film, leaving the porous low-k dielectric material on the partially fabricated integrated circuit.

37. Pertaining to claim 33, Lukas teaches the method of claim 32, wherein the ultraviolet radiation directly interacts with the porogen to produce volatile decomposition products, thereby facilitating removal of the porogen from the precursor film (as described above).

38. Pertaining to claim 34, Lukas teaches the method of claim 32, wherein the oxidizing conditions comprise at least one of ozone and oxygen radicals [0062].

39. Pertaining to claim 35, Lukas teaches the method of claim 32, wherein the ultraviolet radiation comprises light at a wavelength that produces at least one of ozone and oxygen radicals (as described above).

40. Pertaining to claim 36, Lukas teaches the method of claim 35, wherein the ultraviolet radiation comprises wavelengths ranging between about 156 and 500 nm (as applied to the rejection of claim 27).

Objections

41. Claim 37 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

42. Any inquiry concerning this communication or earlier communications from the examiner should be directed to W. David Coleman whose telephone number is 571-272-1856. The examiner can normally be reached on 9:00 AM-5:00 PM.

43. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

44. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

W. David Coleman
Primary Examiner
Art Unit 2823

WDC